NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
VOLUNTEER RIVER ASSESSMENT PROGRAM (VRAP)
2006 PROGRAM REPORT AND QA/QC AUDIT

I. PROGRAM SUMMARY

In 2006, VRAP supported 24 volunteer groups on numerous rivers and watersheds throughout the state (Table 1). VRAP volunteers conduct water quality monitoring on an ongoing basis. Each year VRAP has continued to grow both in terms of the number of groups participating and the amount of useable data that is collected. [Figure 1, Figure 2].

Table 1. 2006 VRAP Groups and Waterbodies Monitored

River(s)/Tributaries	Organization Name
Ammonoosuc River	Ammonoosuc River VRAP Group
Ashuelot River	Ashuelot River Local Advisory Committee
Bellamy River	Bellamy River Watershed Association
Cocheco River	Cocheco River Watershed Coalition
Cold River	Cold River Local Advisory Committee
Contoocook River	Contoocook River Local Advisory Committee
Exeter River	Exeter River VRAP Group
Gridley River	Sharon Conservation Commission
Gunnison River	Gunnison River VRAP Group
Hawkins Brook	Meredith Conservation Commission
Hodgson Brook	Hodgson Brook Advisory Committee
Peter's Brook, Brown's Brook	Hooksett Conservation Commission
Isinglass River	Isinglass River VRAP Group
Wildcat Brook, Ellis River, Great Brook	Jackson Conservation Commission
Israel River	Israel River VRAP Group
Lamprey River	Lamprey River Watershed Association
Oyster River	Oyster River Watershed Association
Pemigewasset River, Mad River	Pemigewasset Local Advisory Committee
Pennichuck Brook	Nashua Regional Planning Commission
Piscataquog River	Piscataquog River Watershed Association
Powwow River	Powwow River VRAP Group
Saco River	Bartlett Conservation Commission
Salmon Falls River	Somersworth 4H Club
Smith River	Lake Winnipesaukee Watershed Association

Figure 1. NHDES VRAP Participation (1998-2006)

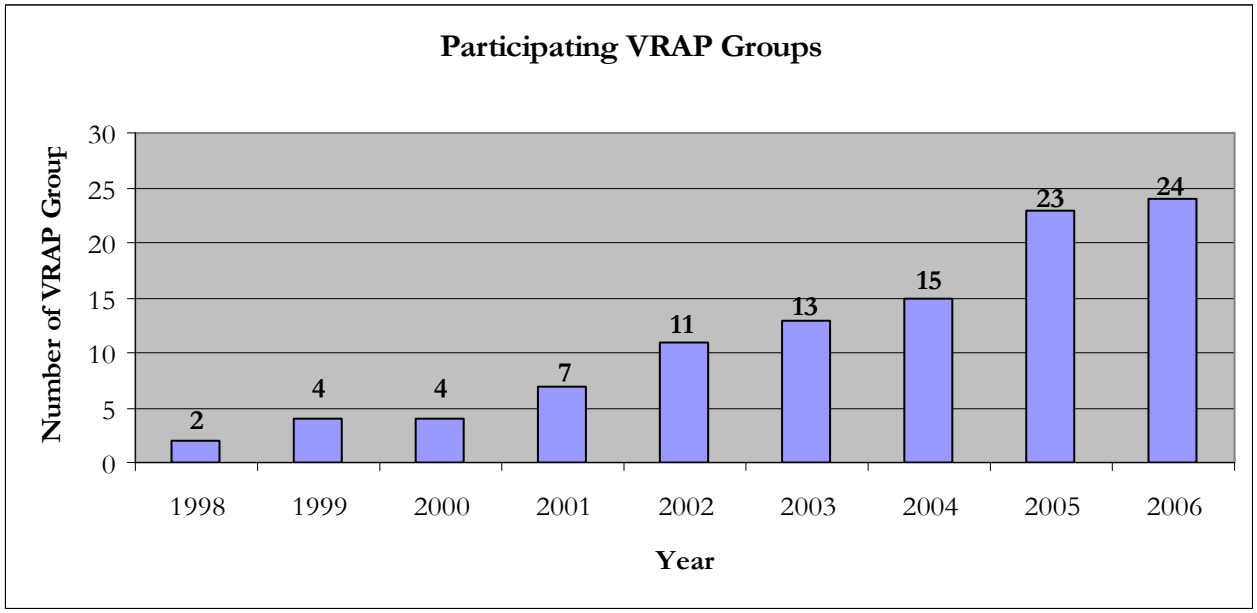
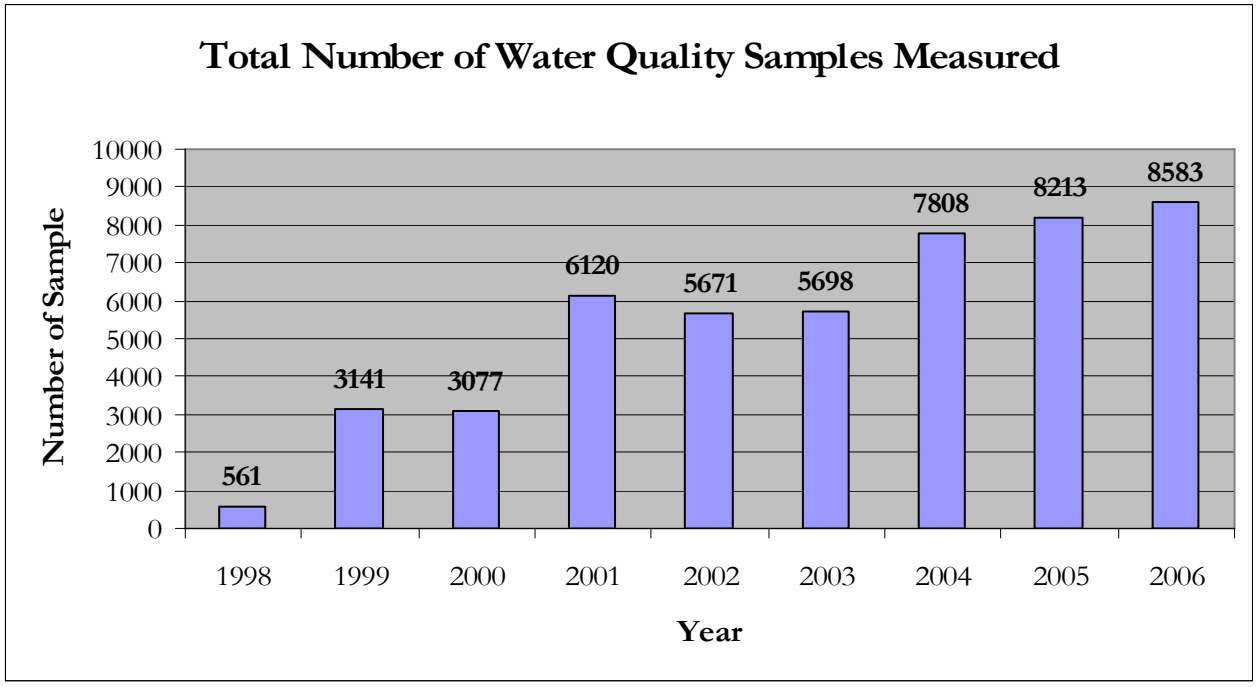


Figure 2. Annual Summary of Instantaneous Measurements (1998-2006)



During 2006 the VRAP program worked to continually improve the program both in its ability to collect quality environmental data and it the service the program provides to the volunteer groups participating.

2006 Administrative Highlights

- In December of 2005, another staff member was hired such that there are now two individuals coordinating the VRAP program.

  Ted Walsh, VRAP Program Manager
  Jen Drociak, VRAP Coordinator

- In 2006, five VRAP groups purchased their own equipment kits, alleviating the strain on the fixed number of VRAP kits to be loaned to groups throughout the sampling season. VRAP also purchased an additional five equipment kits in 2006.

2006 Outreach and Education Highlights

- In January 2006, the VRAP website was completely revised to be more user-friendly, more intuitive, and include additional publications and informational resources, as well as educational resources.
- In February of 2006, a survey was distributed to all VRAP groups seeking input in how the program could be improved and to allow participating groups to evaluation state of the program. Many helpful suggestions were received and incorporated into the planning process for the 2006 monitoring season.
- In March of 2006, VRAP created a 10-page document entitled ***"Native Shoreland/Riparian Buffer Plantings for New Hampshire".*** This document contains a table of over 90 suggested native shoreland/riparian buffer plantings for New Hampshire. The table contains common name(s), Latin name, height, growth rate, rooting, light preference, soil preference, and associated wildlife and food value of each tree, shrub, and groundcover/herbaceous perennial species. This document is available in Adobe PDF format via the VRAP webpage and the Shoreland Protection Program webpage.
- During April and May of 2006, VRAP organized 11 annual training workshops. Training workshops were held in New Boston, Meredith, Goshen, Keene, Littleton, Madbury, Bethel Maine, Epping, Bennington, Nashua, and Portsmouth. **141 volunteers** attended the events.
- In June of 2006, VRAP released its first annual programmatic newsletter, entitled ***"Streamlines".*** This was distributed in Adobe PDF format via e-mail distribution groups, and made available via the VRAP website.
- In October of 2006, VRAP released a field guide entitled ***"A Field Guide to Common Riparian Plants of New Hampshire"***. This full-color field guide was created for VRAP volunteers to assist in identifying common native and non-native riparian plant species. Over 70 plant species are described in the text, with additional live plant scans and habitat photos. The guide is organized into six sections: In the Water: Submerged Aquatic Plants; On the Edge: Emergent Herbaceous Plants; Ferns; Woody Shrubs; Climbing Vines; and The Canopy (Trees). Appendices include: Other Helpful Field Guides; Glossary of Terms; Leaf Shapes & Arrangements; and Native Shoreland/Riparian Buffer Plantings for New Hampshire and is available in Adobe PDF format via the VRAP website.
- Other outreach/educational documents created in 2006 included ***a "Glossary of River Ecology Terms",*** and ***"Floodplain Forest Communities in New Hampshire".***

2006 Monitoring Highlights

- During 2006, 254 stations were monitored by VRAP volunteers. This monitoring effort generated a total of 8,583 instantaneous datapoints useable for assessment purposes.
- In addition to instantaneous measurements, NHDES and VRAP volunteers utilized multiparameter dataloggers and water temperature dataloggers to collect more detailed information on dissolved oxygen, pH, specific, conductance and/or water temperatures. These dataloggers generated an additional 88,650 datapoints.
- NHDES staff and volunteers from the Hodgson Brook Advisory Committee successful installed a stream gage to be used by volunteer to generate flow data. NHDES helped develop

a rating curve for the gage that would be used to translate stream gage readings into discharge data useable for pollutant loading calculations.

- VRAP initiated a pilot winter monitoring program. The goal of this program is to collected specific conductance and chloride data during winter and snowmelt months to document the impact of road salts on rivers and streams.

II. 2006 QA/QC VRAP SUMMARY

The QA/QC procedures incorporated into the VRAP QAPP are designed to generate data that is of sufficient quality to by useable in NHDES's 305(b) 303(d) reports. Field SOP's and manuals are written to translate the QA/QC requirements of the QAPP into terms and explanations useable by volunteer monitors. Frequent QA/QC check by VRAP staff, field audits, and open communication lines with the VRAP groups are to ensure that proper QA/QC procedures are being followed and that a maximum of data collected is useable for assessment purposes.

Documentation/Data Verification

Upon submission of datasheets to NHDES, VRAP staff go though a detailed QA/QC check to determine what status the data should be flagged with in the Environmental Monitoring Database (EMD).

1. Data is manually entered into the EMD. Templates already exist in the EMD to ensure the proper scientific methods and parameter specific units are documented.

2. Data is extracted from the EMD and checked again against the original datasheets. Any errors are corrected. If necessary VRAP staff will contact the appropriate volunteer coordinator to verify the data.

3. The data is then checked against the QAPP requirements documented in Table 1. Data that is invalidated is flagged as such in the EMD with an explanation of why the data was invalidated. (i.e. RPD of sample/replicate 23% - exceeds QAPP requirements of <10%). Data that is invalidated is also documented in the annual VRAP reports to each group.

The VRAP Quality Assurance/Quality Control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in volunteer sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.

- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.

- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.

- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.

- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.

- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \ \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	RPD < 10% or Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (Zero Air Reading)	± 5.0 µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <0.5 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

III. SUMMARY OF 2006 QA/QC RESULTS

A. Description of Training Activities

For Volunteers:

- During April and May of 2006, VRAP organized 11 training workshops. Training workshops were held in New Boston, Meredith, Goshen, Keene, Littleton, Madbury, Bethel, Epping, Bennington, Nashua, and Portsmouth. Over 140 volunteers attended the events. Topics included: calibration and meter checks, quality assurance and quality control, sample collection for field and laboratory analysis, order of field tests, sampling techniques, and instruction on water quality parameters and state standards.

- Between June – August 2006, 12 field audits were conducted by VRAP staff. To facilitate this process, a *"Field Sampling Procedures Assessment"* data sheet was created to be used to assess sampling procedures during the field audit.

For the VRAP Intern:

The VRAP intern hired for the 2006 season was a returning intern from the 2005 season. The intern had remained at NHDES part-time during the winter between the two seasons. Although some training exercises were conducted, only reviews were necessary due to the experience of the intern.

- VRAP intern was trained on proper use of the water quality sampling equipment according to the approved SOPs. This instruction was given at the NHDES office in Concord.

- VRAP intern attended an EPA sponsored training on the proper use of multiparameter dataloggers. Training included topics such as calibration procedures, post retrieval QA/QC checks, proper deployment, and extraction of data.

B. Documentation of Usable Data Versus Actual Data Collected

Field Measurements and Grab Sampling

VRAP staff reviewed all results from field sampling and laboratory analysis. Comments relative to the field data were written directly on the field data sheets, whereas comments relative to laboratory data were written directly on the laboratory results sheets. Table 2 summarizes the number of data points collected for each parameter and the corresponding number and percent of invalid data. **During 2006 8,583 instantaneous data points were collected via the VRAP program. Of these 234 or 2.7% were ruled invalid.**

Data was classified as invalid if calibrations were not conducted, replicates did not meet the requirements in Table 1], or the program manager had other reasons to question the validity of the data. The invalid data were input to the Environmental Monitoring Database (EMD), but will not be used for surface water quality assessment purposes. Invalid data is specifically flagged in the EMD as such.

Table 2. Summary of Data Verification (Field /Laboratory Samples)

Parameter Name	Units	Total Count	Invalid Count	% Invalid
Aluminum	mg/L	8	0	0
Biochemical Oxygen Demand (5-Day)	mg/L	10	0	0
Cadmium	mg/L	54	0	0
Chloride	mg/L	32	0	0
Copper	mg/L	54	0	0
Depth	ft/m.	29	0	0
Dissolved Oxygen	mg/L	1067	68	6.4%
Dissolved Oxygen	% Sat.	1069	67	6.3%
E.coli	cts/100ml	435	12	2.8%
Flow	cfs	0	0	0
Hardness	mg/L	6	0	0
Lead	mg/L	54	0	0
Ammonia	mg/L	36	0	0
TKN	mg/L	65	0	0
Nitrate	mg/L	52	0	0
Nitrate/Nitrite	mg/L	14	0	0
pH	std. units	1064	61	5.7%
Total Phosphorous	mg/L	260	1	0.4%
Orthophosphate	mg/L	34	0	0
Specific Conductance	µS/cm	1076	17	1.6%
Air Temperature	°C.	1036	1	0.1%
Water Temperature	°C.	1111	1	0.1%
Turbidity	NTU	961	6	0.6%
Velocity	ft/sec	15	0	0
Zinc	mg/L	54	0	0
TOTAL		**8583**	**234**	**2.7%**

Submersible Multiprobe Measurements

In addition to collecting data via instantaneous readings and laboratory samples, VRAP uses multiparameter dataloggers and water temperature dataloggers to collect water quality data. The multiparameter dataloggers are capable of measuring dissovled oxygen (mg/L and % sat.), pH, conductivity, and water temperature. All dataloggers can record data at a user defined time interval (generally 15 minutes).

The dataloggers are calibrated prior to deployment, deployed for 3 – 7 days, and QA/QC checked upon retrieval. On a parameter by parameter basis each deployement is flagged in the EMD as valid or invalid. VRAP staff will also look at the data and invalidate individual datapoints where necessary (i.e probe failure, data collected out of water) During 2007 a total of 34 multiparameter or water temperature datalogger deployments were conducted for the VRAP program. Table 3 summarizes the amount of data collected at VRAP stations during 2006.

Table 3. Summary of VRAP Datalogger Deployments – 2006

Station ID	Waterbody Name	Town	Dissolved Oxygen (mg/L)	Dissovled Oxygen (% Sat.)	pH	Specific Conductance (µS/cm)	Water Temp. (°C.)
00E-CGB	College Brook	Durham	660	660	660	660	660
00J-PRB	Pettee Brook	Durham	667	667	667	667	667
00M-HOB	Hodgson Brook	Portsmouth	582	582	582	582	2267
01-BAT	Borthwick Ave. Trib	Portsmouth	487	487	487	487	487
01-CRB	Crane Brook	Langdon	679	679	679	679	2721
01-CTP	Country Pond Outlet	Newton	574	574	574	574	574
01-THT	Unnamed Trib To Thorn Hill Trib	Jackson	0	0	680	680	680
01-WLD	Wildcat Brook	Jackson	470	470	470	470	470
01T-SOP	South Branch Piscat.	New Boston	0	0	0	0	2073
02-TRB	Thorn Hill Trib	Jackson	0	0	680	680	680
02A-MAR	Mad River	Farmington	0	0	0	0	1977
02X-HOB	Hodgson Brook	Portsmouth	488	488	488	488	488
03-ELL	Ellis River	Jackson	385	385	385	385	385
03-PWW	Powwow River	South Hampton	573	573	573	573	573
03-TRB	Thorn Hill Trib	Jackson	0	0	681	681	681
04-CBY	Colby Brook	Danville	575	575	575	575	575
04-ISG	Isinglass River	Barrington	0	0	0	0	1540
04-PRB	Pettee Brook	Durham	657	657	657	657	657
05-HOB	Hodgson Brook	Portsmouth	492	492	492	492	492
06M-CLD	Cold River	Acworth	0	0	0	0	2045
07-ELL	Ellis River	Jackson	475	475	475	475	475
08-HOB	Hodgson Brook	Portsmouth	495	495	495	495	495
08-WCH	Witches Brook	Hollis	481	481	481	481	2162
10A-PWW	Powwow River	Kingston	575	575	575	575	575
14-ISR	Israel River	Jefferson	0	0	0	0	1662
15-ASH	Ashuelot River	Swanzey	571	571	571	571	571
15B-EXT	Exeter River	Brentwood	484	484	484	484	484
17-ASH	Ashuelot River	Keene	487	487	487	487	487
18E-LMP	Lamprey River	Raymond	383	383	383	383	383
18M-LMP	Lamprey River	Raymond	381	381	381	381	381
19-ASH	Ashuelot River	Keene	479	479	479	479	479
20A-ASH	Ashuelot River	Keene	475	475	475	475	475
23-ASH	Ashuelot River	Gilsum	0	0	0	0	2157
25Z-CTC	Contoocook River	Peterborough	558	558	558	558	558
Individual Parameter Totals			**13,133**	**13,133**	**15,174**	**15,174**	**32,036**
Total Data Points			**88,650**				

IV. SUMMARY

In 2006 the VRAP program collected more data and monitored more stations than in any previous year. The program continues to develop and expand, while maintaining the quality assurance/quality control processes that form the core of the program. VRAP volunteers are invaluable in protecting and preserving New Hampshire's rivers and streams and for being local stewards who help education the community regarding the importance of good water quality. We are looking forward to continue growth and development in 2007.